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# FOUR WEEKS IN THE WILDERNESS OF SINAI, WITH NOTES ON EGYPT.\*

BY

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It is to be remembered that my experience in the Peninsula of Sinai was limited to a single visit.

Arriving in Cairo February 1st, 1889, I spent the first week of this month in Cairo, the second and third on the Nile, the fourth, and the first two weeks of March, again in Cairo and vicinity. I entered the desert, March 13th, and four weeks later returned to Cairo, finally leaving Egypt on April 15th.

In the earlier weeks named, the temperature at the hotel in Cairo ranged from 60° to 65° at 8 A. M. to 75° and 78° at 3 P. M., falling to 64° and 67° in the evening. In April it was warmer, but never oppressive in the shade. On the Nile steamer greater extremes were noted; 54° at midnight (Feb. 19th) to 87° at 2.30 P. M. (Feb. 9th). The latter figure was exceptional and was regarded as oppressive, but the changes in any period of 24 hours are not commonly very great. Luxor is attaining some reputation as a health resort, on account of the equable temperature and dryness of the atmosphere. In the first three months of 1889, the average temperature out of doors at the hotel is thus given :

	9 A.M.	2 P.M.	6 P.M.
January... ..	60°	68°	65°
February.....	60°	70°	68°
March .....	71°	81°	78°

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\* A paper read by Dr. Bolton before the New York Academy of Sciences.

Authorities state that, as a result of ten years' observations, the mean temperature in the Delta and at Cairo is  $58^{\circ}$  in winter,  $83^{\circ}$  in summer, and  $66^{\circ}$  in autumn; the lowest record in the Delta is  $35^{\circ}$ , the highest about  $95^{\circ}$  in the shade. In Upper Egypt, however, the temperature rises to  $109^{\circ}$ .

The temperatures that I noted in the desert of Sinai were taken at great differences of elevation, my route extending from the sea-level to the summit of Jebel Mousa, 7,400 feet high. I copy a few records from my journal.

*In Plain of Shur (perhaps 50 ft. above sea-level.)*

March	13th.....	7.30 A.M.	$59^{\circ}$
"	".....	3.00 P.M.	$80^{\circ}$ in sun
"	".....	8.30 P.M.	$66^{\circ}$
March	14th.....	7.00 A.M.	$50^{\circ}$
"	".....	7.00 P.M.	$70^{\circ}$
March	15th.....	7.00 A.M.	$62^{\circ}$
"	".....	9.30 P.M.	$75^{\circ}$ (south wind)

*In Wadi Feirân, and beyond.*

March	19th.....	6.30 A.M.	$52^{\circ}$ (rain)
"	".....	9.00 P.M.	$52^{\circ}$

*At Monastery of St. Catherine (5,000 ft.)*

March	21st.....	8.00 A.M.	$48^{\circ}$
"	".....	9.00 P.M.	$55^{\circ}$
March	22d.....	6.30 A.M.	$46^{\circ}$
"	".....	10.00 P.M.	$56^{\circ}$
March	23d.....	8.00 A.M.	$57^{\circ}$
"	".....	9.30 P.M.	$60^{\circ}$
March	24th.....	7.00 A.M.	$54^{\circ}$
"	".....	10.00 P.M.	$62^{\circ}$
March	25th.....	7.30 A.M.	$59^{\circ}$
"	".....	11.00 A.M.	$72^{\circ}$
"	".....	10.30 P.M.	$66^{\circ}$
March	26th.....	7.00 A.M.	$62^{\circ}$
"	".....	9.00 P.M.	$66^{\circ}$

*Wadi Es-Sleh to Tor.*

March	29th.....	6.00 A.M.	(Wadi) $67^{\circ}$ (1,500 ft.)
"	".....	3.00 P.M.	(Tor) $88^{\circ}$
"	".....	10.00 P.M.	(Tor) $75^{\circ}$

*Summit of Jebel Mousa (7,400 ft.)*

March 22d.	9.30 A.M.	in shade, 46°
"	"	in sun, 70°

*Camp on Gulf of Suez.*

March 31st.	9.00 A.M.	in sun, 88°
"	"	in shade, 72°

*On Seetzens Slope, Jebel Nagous.*

March 31st.	11.00 A.M.	in sun, 86°
"	"	in shade, 72.5°
"	2.00 P.M.	in sun, 100.5°

The highest evening temperature was on March 17th, after the Khamsin had blown all day,—at 7 P. M., 84°. The lowest temperature observed was on March 20th, in camp about 3,000 feet above the sea,—at 6.30 A. M., 33°.

My first experience in Egypt was calculated to give the impression that it is a rainy country, for I saw two showers in three days. In passing through the Suez Canal (January 31st), a heavy shower, lasting half an hour, drove the passengers to shelter, and a brilliant rainbow delighted beholders. Two days later, rain again fell at night in Cairo. Of course this experience was exceptional in Cairo. The rainfall at Alexandria is about 8 inches per annum, and at Cairo about 1.2 inches; while in Upper Egypt there are adults living who say they have never seen rain.

I noticed, on the other hand, unmistakable signs of recent rains, such as dried mud-puddles, raindrop-prints, etc., at several points, near Cairo, east of Thebes (Wadi Bab-el-Molook), and in the peninsula of Sinai, and I was impressed with the belief that more rain falls in Egypt than is usually supposed. A local shower passing over a sandy, gravelly region, makes but little

impress on it; and there is no corps of trained observers, outside of Cairo and Alexandria, to record the phenomenon. On visiting the Khedivial Astronomical Observatory just out of Cairo, I was cordially received by the Director, Mr. T. Esmatt, a graduate of the Ecole Polytechnique of Paris, and for three years an assistant in the Naval Observatory at Washington. I take pleasure in mentioning his politeness and courtesy, but cannot omit pointing out a weakness; he took me to the roof of the building to see the meteorological instruments, and I noted that the rain-gauge was quite full of water; this again gave me reason to regard Egypt as a rainy country. (The last shower fell one month previously.)

Being on the lookout for signs of water in the desert of Sinai, I made the following notes:—The slight depressions in broad plains and the deep, narrow valleys in the hill country, both indiscriminately called wadis, present the appearance of dried-up water-courses: the signs are unmistakable,—a tortuous channel with vertical sides carved out of the gravelly bottom, pebbles and boulders transported from distant sources scattered over the surface, mud-flakes and mud-cracks in small bays, as it were, at the sides of the main channels. At two or three places on the sea-coast, extensive mud-flats were pitted with characteristic raindrop impressions. The line of the now arid water-course was often bordered by scanty and hardy shrubs.

Between March 13th and April 8th (1889) rain fell three times in my vicinity; twice the fall was insignificant, but on March 19th rain fell abundantly in Wadi Feirân, from 7.15 A. M. to 9.30 A. M. Heavy mists had

obscured the peaks bordering this extensive valley nearly all the preceding day; the temperature during this rainfall was 52°, elevation about 1,900 feet.

That heavy falls of rain and even of snow occur in December and January in the Sinai region, is reported by many travellers; in the defile of Nakb-el-Hawi (5,000 feet) crossed by pilgrims *en route* for the sacred mountain, the winter rains make veritable torrents; in 1867 the water rose to such a height in the valley adjoining Wadi-Selâf, as to wash away a camp of Bedouins, causing a loss of 40 lives and of numerous cattle (Baedeker). Captain Palmer describes also a sudden precipitation so copious as to fill the bottom of Wadi Feirân to the depth of several feet, causing the party to seek high ground. That the Oasis of Feirân was once a site sufficiently important to become an Episcopal See, is known to students of history; this was in the second to the sixth century A. D. A few cut stones, the capital of one column, and ruined sites, alone remain to indicate the locality.

Judging by the great boulders and trunks of palms which I saw in the lower part of this valley, I am disposed to believe that heavy rains are not infrequent. Casual observations by travellers, who move their tents almost daily, are unreliable data for scientific conclusions as to the meteorology of the country. Unfortunately, the monks residing at the Monastery of St. Catherine, care for none of these things.

Returning for a moment in thought to the Nile valley, I note that although the sun usually shines with great brilliancy, it is a mistake to infer that the sky is uniformly cloudless. In March there were many cloudy

days, some of which would, in this country, have been regarded as rain precursors.

Powerful winds sweep across the plains and through the valleys of Arabia Petræa, with a violence and continuity that I have not elsewhere experienced. In the spring months the prevailing wind in the desert is from the north and northwest, down the Gulf. This wind is a cool one, but it occasionally veers around to the south and becomes oppressively hot. In April and May this south wind, called *Khamṣīn*, blows unrelentingly for days together, scorching the traveller's skin and filling the orifices in his head with a very fine dry dust. *Khamṣīn* is from an Arabic word meaning fifty, so called from a mistaken notion that it blows for a period of fifty days before the summer solstice.\*

In the Nile valley, north winds prevail during the heated period of eight months, and southern winds during the rest of the year; these being in the opposite direction from the winds in the region of the Red Sea.

I witnessed three characteristic sand-storms at localities far apart and under varied circumstances. On February 15th, when riding a donkey through Thebes Nileward, a powerful west wind arose in the afternoon, blowing before it the fine dust from the Libyan desert. Words fail to describe the discomfort of such a sand-storm; the fine dust seems able to penetrate everything except perhaps an unbroken egg, and it is quite impossible to escape from it; to prevent suffocation, I borrowed from a fellah a coarse yet closely-woven blue outer garment and wrapped my head up. Donkeys did

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\* The dictionaries agree in defining *Khamṣīn* as a wind that blows for fifty days, beginning about the time of the vernal equinox.

not seem to enjoy the phenomenon any better than the Bedouins, and they shrunk from its blast as well as the travellers. On reaching the river, we alighted, but found the waves so high that boats could not cross to take us over, and we had to wait in patience until the force of the wind was spent. I tried lying down on the shelving shore, but the coarser grains of sand driven near the surface cut into the skin with painful effects. After crossing to Luxor in a boat, we found the residents in the large hotel much inconvenienced by the penetrating dust, although the building is screened by a handsome garden.

My second experience was in Cairo itself. On March 6th a northwest, and consequently a cool, wind blew dust from the adjoining desert into the city with such power as to obscure the usually brilliant sun during an entire day. The barometer fell 0.46 inch at the time, and the thermometer indicated 66° at 8.30 A. M., and 67° at 10.30 P. M. Residents of Cairo said that the sand-storm was the severest in twenty-five years, and of an unusual character,—being accompanied by a low temperature instead of the scorching Khamsin. The following day was clear and cool. The dust penetrated every cranny and gave hotel servants hours of labor.

I experienced a third sand-storm in the desert of Sinai, on the plain of El Markha; it was accompanied by a scorching south wind, and the drying effects on the skin and the capital orifices produced greater discomfort than the suffocating dust and cutting sand; my party could do nothing but sit in silence on the camels, facing the storm, and the poor animals forgot to snatch at the tufts of scanty shrubs, as is their custom. After



crossing the plain, we entered a defile and rose to a considerable height on the Nakb-el-Budra ; the sand-storm continued, quite spoiling our enjoyment of the wild scenery and making photography impossible. In the evening the fierce wind very nearly overturned our tents in spite of extra stays, and at dinner every course was seasoned with the all-penetrating dust. The temperature at 7 P. M. was abnormally high,  $84^{\circ}$  ; just twenty-four hours later it had fallen to  $58^{\circ}$ , the wind having meanwhile veered around to the north, bringing with it heavy mists.

A single instance of electrical display was observed on March 26th, while in camp at Sinai. My companion, Henry A. Sim, Esq., of the Madras Civil Service, while lying in the tent, drew bright sparks from the woollen blankets by friction ; the temperature without was about  $64^{\circ}$ .

Before dismissing the subject of climate, I wish to testify to the invigorating, delightful air in the desert ; it has a bracing quality that enables one to expend much energy without fatigue. From about 1 to 3 P. M. the glare of the sun is often great, and shade is a comfort ; but the constant breeze, sometimes rather too strong, tempers the heat. I suspect, too, that the air is very free from disease-germs.

Of the dreaded Khamsin, however, I can say nothing favorable.

I made several excursions in the neighborhood of Cairo ; on the west lies the river, and across the bridges cultivated fields so far as irrigated ; beyond that the Libyan desert. On the east the quick transition from the streets of a city, swarming with 400,000 inhabi-

tants, to the sterile desert, is very striking; passing through an arched gateway, and by some sorry-looking Mohammedan burying-places, one immediately finds himself on gravelly undulating plains, devoid of water or foliage, extending in monotonous uniformity to the Gulf of Suez, about 80 miles distant. Jebel Mokattam, a lime-stone range on the south, rises nearly 500 feet above the city; my aneroid gave the elevation of the highest point overlooking Cairo as 694 feet above the sea-level, or 485 feet above Shepherd's Hotel. The desert, broken occasionally by low ranges of hills, has a hard gravel and pebble floor, chiefly limestone, with fragments of silex in the form of brown flint and chalcedony. Loose sand lies only in hollows between hills, the tops of which are wind-blown and bare. On the surface at certain points lie fragments of fossil wood, and rarely half-buried trunks of the same; it is dignified by the name of "Petrified Forest." Some of this fossil wood proves to be good phonolite.

I noticed here again evidences of water-courses, recent mud-flakes, etc. At the time of my visit the customary strong cool breeze prevailed, and the temperature was 74° in the shade at noon (March 8th).

On February 16th I visited a wild valley west of Thebes, known as Wadi Bab-el-Molook, celebrated for the numerous and well-preserved Tombs of the Kings, of great interest to archæologists. My experience and impressions of this arid region were as follows:

Passing from the river bank through green cultivated fields of the Nile basin, the sterile, gravelly desert begins abruptly, the sudden transition being determined

by the irrigating canals and channels. At the mouth of the valley, about two miles from the Nile, the scene is one of utter desolation; absolutely no vegetation of any description is visible, not a dry lichen nor a gray shrub. Beneath the feet is a hard gravelly floor, grayish-white in color, consisting of broken and powdered limestone from the neighborhood, intermingled with nodules and pebbles of silex. True flint, from white to liver-brown in color, and having characteristic conchoidal fracture, is abundant. The silex commonly takes the concretionary form, some of the shell-like and ring-shaped masses reminding one of fossils. But little sand is present.

At the entrance of the valley the hills rise at a gentle slope, their sides being here and there dotted with large masses of limestone with a firm cement, or rather with seams, of dark-colored quartz. The strata, as seen by the unaided eye, appear to be horizontal. The rock has a shaly character in places, being deeply weather-eaten, friable, and soft. Ascending the valley, a spur divides it into two converging ravines; following the longer one to the west, the walls of limestone become precipitous, the quartzitic masses larger, and the general aspect wilder. At some places the limestone runs into chalk; this is especially well seen on entering one of the numerous Tombs of the Kings, the inclined passages penetrating hundreds of feet into the heart of the mountains.

The valley terminates in a *cul-de-sac*, about half a mile from its mouth, forming an amphitheatre of nearly vertical walls apparently 200 feet high, above which rise steep slopes perhaps 500 feet higher. These verti-

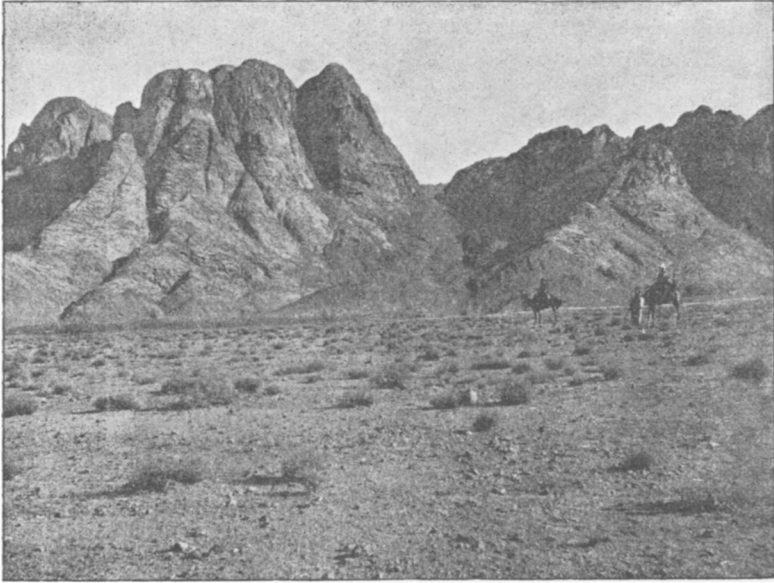
cal walls are split by vertical joints into broad or narrow columns, making picturesque features.

The valley throughout shows that water has at some time been energetically at work ; the floor resembles a dried-up mountain torrent ; banks of gravel, sand, and boulders rise several feet above the bridle-path on each side ; and at the lowest part, small channels wind about the large rocks. The hillsides are furrowed by ravines excavated by water. Here and there in low places, usually at the foot of a large boulder, were unmistakable signs of recently-formed mud. The scales and mud-cracks were quite fresh, and seemed to indicate that water had accumulated in pools not more than two or three weeks before. On my return to Luxor, I was informed that rain had fallen about three weeks before (February 16th).

A sharp peak rises high above the walls of the amphitheatre referred to ; on the slopes of this peak several parallel bands of horizontal limestone differ in compactness, the softer wears away rapidly and the harder projects over the shaly inclines.

Climbing up a steep path, and crossing the narrow ridge through a slight depression, I descended into the valley of the Nile ; limestone passed into shale, and this into cultivated ground. The numerous excavations of small tombs, the grand ruins of the Rameseum and of Medinet Haboo, with the Colossi standing like sentinels on the plain, now drew off my attention from the geological features of the place.

The physical geography of the Sinai region is rarely represented with accuracy on published maps ; Sinai often appears as an isolated peak, or at most as a detached



MT. SINAI.

group of mountains, whereas the whole peninsula is covered with sterile hills and clusters of mountains, except on the borders of the three seas by which it is bounded. The best maps known to me are those published by the Ordnance Survey, and by the Admiralty of Great Britain; these seem to be topographically complete, but Jebel Nagous is not shown with accuracy. My own observations were limited to the following route: from Suez to Sinai by the usual caravan route through Wadi Feirân, thence through Wadi Es-Sleh to Tor on the Gulf, and back to Suez by the usual route along the sea-coast, a distance of about 380 miles. The region, which is about the size of New Hampshire, contains within its boundaries three marked features:

comparatively level plains, low ranges of limestone and sandstone hills, and an irregular group of bold granite mountains whose peaks rise to the height of 8,000 feet. Each of these regions is furrowed by wadis, or dry water-courses, which present very different aspects in the three divisions named. In passing from Suez to Sinai, by the usual route, one meets these features in the order named.

The first 52 miles of the journey, occupying about two days and a half, as camels travel, passes over an arid, sterile plain about ten miles wide from the low range of limestone hills on the east, Et Tih, to the Gulf on the west. This plain, like that of El Gâa, to the south, rises gradually from the sea to the foothills, and is undulating towards its southern end. It is crossed by broad, shallow wadis, running east and west, which were perfectly dry at the time of my visit; Wadi Werdân, the largest, is depressed but a foot or two below the level of the plain and is approximately three miles in width at about six miles from the point where it enters the sea.

The most extensive plain on the western side of the Peninsula is that of El Gâa, which is about 80 miles long and 15 wide at its widest point. From the sea-coast to the mountains bordering it on the east, it rises nearly 1,000 feet, but so gradually as to deceive the eye and appear level. It is crossed by many shallow wadis, and its northern half is separated from the sea by a range of limestone hills (Jebel-el-Araba) reaching a height of 1,600 feet. When the plain was covered by the sea, this range was probably an island, or series of islands. The plain is rarely broken by hills, the sharp-pointed

Krên Utûd, conspicuous from a distance, being an exception. I crossed the monotonous desolate waste, from the mouth of the beautiful Wadi Es-Sleh to Tor (or Tûr), on the Gulf, a distance of about 15 miles, and noted scarcely a dozen tufts of plants; water is absolutely wanting. North of Tor, however, and east of Jebel-el-Araba, are palm-gardens that extend for several miles in a narrow belt; and these date-bearing trees owe their existence to several saline springs, occurring at intervals, some of which are quite warm. On this sterile plain, the characteristics of a desert are seen in perfection; the level expanse is not too broad to conceal the lofty mountains on the east, nor to prevent glimpses of the blue sea on the western horizon; the floor is a firm hard surface, made up of a compact mixture of gravel and coarse sand, so hard indeed that camels make no impress on it with their broad feet. At some places the surface pebbles are of many shades of brown, intermingled with black and white, and these are so closely laid and regularly distributed as to resemble a mosaic pavement, but of course a patternless one. The surface particles are generally coarser than those immediately beneath; they are chiefly limestone, sometimes of coralline limestone, intermingled with flint and other varieties of amorphous quartz. Many of the pebbles show on their surface beautifully regular pittings and furrows carved out by the wind-driven sand. The fine-grained sand has all been lifted high in air by the powerful winds, whirled away and dropped into depressions or on the lee sides of hills. Hundreds of acres have no surface stones larger than an ostrich-egg; no water whatever is found in this region, much

less any signs of vegetable or animal life, rarely even a passing bird.

On this desolate plain, when overtaken by night, one place is as good (or bad) as another for pitching the tents, unless perhaps a small hillock is reached, which may serve as a partial shelter from the gales that sometimes threaten to overturn the canvas.

In the region of extensive plains, the wadis, or dried-up water-courses, being depressed but little, closely resemble them. The floor of the wadi hardly differs from that of the plain, except when a torrent has swept before it large boulders and deposited them irregularly in its bed. The sorting power of the water, however, is noticeable, as also the well-defined vertical walls, perhaps only a few inches deep, excavated at the point of lowest level. On the margins, too, of the wadis of the plain, and at points protected from the full force of the winter floods, several varieties of green shrubs grow in widely separated tufts. I often remarked mud-cracks, apparently of recent date ; but these indications of water probably remain undisturbed in this desolate region for a considerable period, perhaps for several seasons.

In the limestone hills these wadis take the form of cañons, having nearly vertical walls, sometimes hundreds of feet high—as in Wadi Tayyibeh. The regular erosion on their sides produces often picturesque effects, as at Ras Abu Zanimah.

In the granitic district the wadis form V-shaped valleys broken by narrower ones entering at right angles, and bounded by bold peaks many thousand feet above the beholder. In the beds of these wadis are scattered specimens of the rocks of the surrounding country ;



often boulders of great size testify to the violence of the torrents during the winter months, especially in Wadi Feirân.

The absolute dependence of the population of Egypt upon the Nile is a familiar fact.

The conditions of occurrence of water in the desert are perhaps less familiar. Not only is water scarce, but when obtained a large proportion of it is saturated with saline matter to such an extent that the soil in the vicinity is white with efflorescent salts of soda, magnesia, and lime. The "bitter waters" of Marah are not exceptional. The longest journey that I made without meeting good drinking-water was on the return from Tor to Suez, a distance of about 150 miles, occupying six-and-a-half days. On this route we passed a well in Wadi Gharundel where camels and Bedouins slacked their thirst, and our water-barrel was replenished with water for washing; but had we not been supplied with sweet water from the Nile, brought down to Tor on a boat from Suez, we should have fared badly. At the time of my visit, all wells were very low, and in some places entirely dried up.

Good water, flowing from springs and running short distances,—say, a quarter of a mile before sinking into the thirsty soil,—is found in Wadi Feirân and in Wadi Tarfa. In the former place, many date-palms and even barley-fields make a charming oasis; at the latter, palms, canes, and tamarisks line the babbling brook, as it may truly be named, but the oasis is not extensive. North of Tor, on the Gulf, are flowing springs of warm and saline water, not very palatable, but admirably adapted to the culture of date-palms, of which there are many

thousand. The best drinking-water in the region that I visited is on the flanks of Sinai; there are four wells within the monastery walls, one without, and others in the Leja valley and vicinity.

The warm saline spring at the foot of Jebel Hammam Mousa, is described by several travellers as sulphurous; but at the time of my visit it was assuredly devoid of the characteristic taste and smell of sulphuretted hydrogen. Its temperature is  $92^{\circ}$ – $94^{\circ}$  and it is strongly saline.

Hot springs issue from caverns filled with steam at the base of Jebel Hammam Farûn, a mountain of crystalline limestone on the Gulf of Suez. Russegger says the vapor had a sulphurous smell and the walls of the caverns were encrusted with sulphur. The saline water has a temperature of  $153^{\circ}$ , and is used by the Bedouins for curative purposes.

In Wadi Es-Sleh, the romantic gorge southwest from Sinai, I discovered a cold and sweet sulphur spring, agreeable to the palate. It issues in the centre of the wadi, at a point two hours' journey east of its mouth, and flows a short distance, depositing characteristic bluish sulphur on its borders; it was this latter that first attracted my attention. This spring is not mentioned by Baedeker.

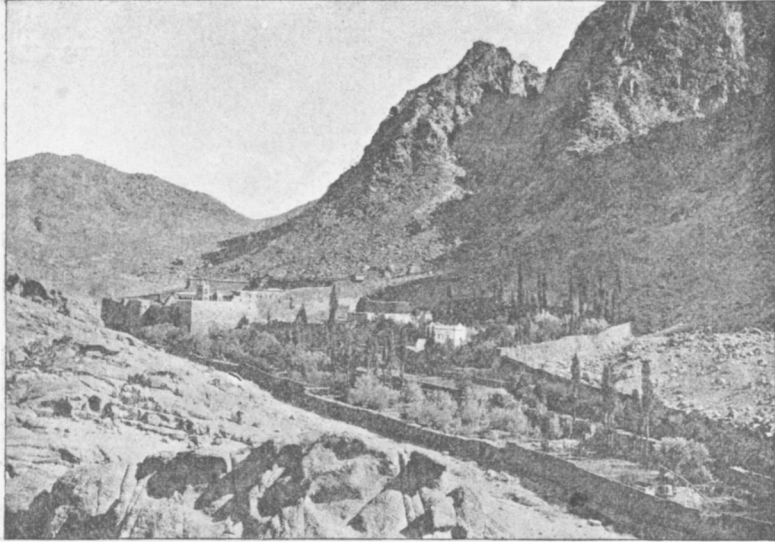
The total absence of ponds and lakes is a marked feature in the peninsula of Sinai; rain does at times fall in abundance, but it rushes down the wadis into the seas. Yet there is evidence of the existence of lakes at some earlier period; in Wadi Feirân, banks of earth 60 to 100 feet high rest on the mountain sides, especially in the angles of the valley, showing clearly the former

existence of a lake, the barrier of which was probably near Hererât. I noticed also at the point where the Wadi Es-Sleh enters the plain of El Gâa, unmistakable signs of an ancient lake ; the wadi emerges suddenly from the mountain range, and a circular depression from 30 to 50 feet deep, with a perfectly level sandy bottom, and bounded by nearly vertical gravel cliffs, now marks the bed of a small lake.

The uninhabitability of the Peninsula is due to its sterility rather than to its climate ; its sterility is due more to the unequal annual distribution of the water, than to its absence, and storage-dams, easily constructed in the narrow granite-walled wadis, would to a great degree remedy this defect. Perhaps at some future day, when a crowded world thrusts its population into regions now hardly habitable, Arabia Petræa will bloom like a garden. Granite and limestone furnish valuable soil ingredients, and the climate is not unfavorable to semi-tropical cultivation.

The extent to which evaporation from the surface cools the contents of the earthenware kullehs is notable ; at 11 A. M. the temperature of the air in the shade was 72°, and that of the water in a goglet (kulleh) only 53°—a difference of 19 degrees. During the cold nights, the water in our barrels fell to a low temperature. A party of Americans who ascended Jebel Katharin, while I was camping at Sinai, found ice near the summit and enjoyed the luxury of iced water.

Fraas says of the Mt. Sinai group : “ This huge range, composed of primeval gneiss and granite, has undergone no geological change since the time of formation of these crystalline masses ; they have reared their ma-



MONASTERY OF SAINT-CATHERINE.

jestic summits above the ocean from the beginning of time, unaffected by the transitions of the Silurian or Devonian, the Triassic or chalk periods." At the base only do these mountains show any trace of alterations ; thus the Red Sea has on one side thrown a girdle of coral around Mt. Sinai, and so produced a coast district ; while towards the north the sea during the Cretaceous period has formed the limestone plateau of Et Tih (4,000 feet above sea-level), which stretches across the peninsula to Mt. Lebanon.

A very remarkable feature is the variety and beauty of the colors of the rocks ; in the limestone region every imaginable shade of yellow, red, brown, and gray, besides snow-white and quite black, give the barren cliffs a picturesque appearance ; in the granite region this gray

crystalline rock is traversed in all directions by dikes of eruptive diorite, varying in color from black to green and brick-red. In Wadi Tarfa I counted nine narrow red and green dikes in a space of twelve feet. Elsewhere the dikes varied in width from two inches to thirty feet and more; sometimes the red porphyry traversed the green, and sometimes both lined the same fissure in the granite. The colors are as well-defined as those on a geological map, and combining with the strong atmospheric coloring of an almost cloudless sky, that produces bright lights and deep shadows in the foreground and an indefinable haze on the distant mountains, together with the deep blue of the mis-named Red Sea, produce an incomparably artistic effect.

The main object of my journey being a search for sonorous sand, my attention was naturally directed to the occurrence of sand in general. Large banks of blown sand are characteristic features in the Nile valley, in the Libyan desert, and in the Peninsula. On the railroad from Ismailiya to Cairo, the authorities have found it necessary to construct long barricades, like our snow-fences, to prevent the drifting sand from burying the track out of sight. In the Nile valley, the fine dry sand has kindly done great service to archæologists; blown into underground galleries used for sepulture, it has preserved intact the artistically decorated walls. Opposite Assouan, Sir Francis Grenfell has recently opened a score of tombs, in which the paintings are as brilliant in color and polish as when completed by the Egyptian workmen centuries before.

As already intimated, loose sand into which the feet sink is confined to the bottom of deep wadis (Tarfa, Es-

Sleh, etc.) inaccessible to high winds, and to banks resting on comparatively level expanses (Gizeh, Ismailiya, etc.) or on the flanks of hills (Jebel Nagous, etc.) In Wadi Feirân, near its entrance into the Gulf of Suez, I noticed a prodigious bank of blown sand, with a rounded summit and regular outline, estimated to be 200 feet high. The bank of sand called Seetzen's Slope at Jebel Nagous, rests on the hillside to the height of nearly 400 feet. The dunes immediately on the sea are comparatively insignificant, eight to twelve feet high at the points reached on my route.

On the southern borders of Lake Timsah (an adjunct of the Suez Canal), a series of dunes extends for more than three miles; some of them rising to the height of 100 feet. At a point about three miles from Ismailiya, between the lake and a shallow lagoon separating it from the desert to the south, the north and south winds meet in an eddy, blowing up the fine yellowish sand in steep slopes, terminating in a long knife-edge ridge. On the steepest inclines the sand has the mobility observed at other localities; there were signs of spontaneous movement down the slope. I tested this sand, but all my efforts to coax sound out of it were futile. The sand beneath the surface was not so dry as that observed in the desert.

The dunes are quite without structure; the sand is uniform in grain and color, from the very edge of the lake up over the top of the ridge. No shrubs or blades of grass find foothold on the arid slope; the surface is everywhere marked by wind-furrows, except where obliterated by the spontaneous sliding mentioned.

The abrading and sculpturing by wind-driven sand

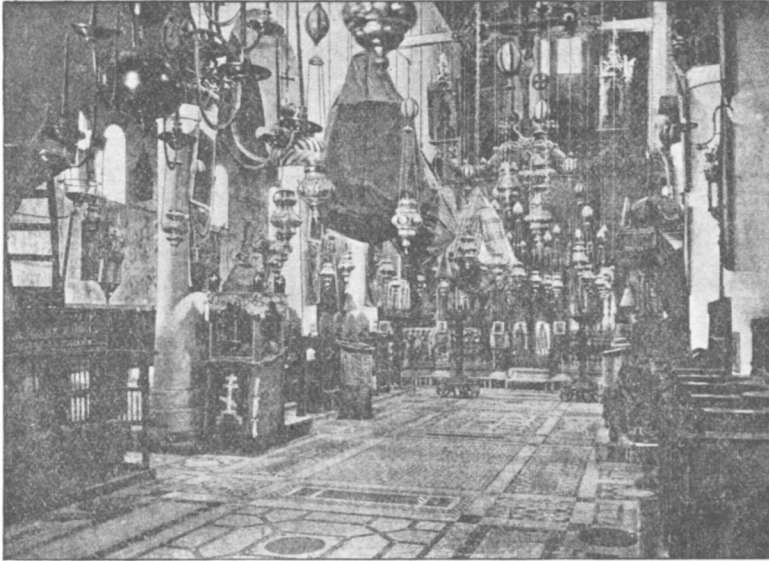
may be seen in many places ; on the Nile, inscriptions on granite temples and obelisks are sadly defaced where exposed to this agent ; and in the desert most picturesque effects are seen, especially in the sandstone region. On the plains, surface pebbles show a delicate pitting and furrowing caused by the sand-blast, not only on soft gypsum and limestone pebbles, but on crystalline quartz.

Minerally the Peninsula is very poor. I collected at different points snowy gypsum, fair selenite in imperfect crystals, and massive white chalk, and noted thin streaks of epidote, small garnets and quartz crystals. The turquoise-mines of Maghâra, which were worked under the Pharaohs, and reopened in 1863, are now abandoned.

The variety, beauty, and fragrance of the shrubs and flowers in the most forbidding and unexpected spots, were to my unprepared mind a remarkable feature. In March I gathered dandelions and daisies at Wadi Useit, also "butter and eggs" ; in Wadi Tayyibeh, near saline water, spearmint ; and in Wadi Feirân, on the hillsides, sorrel.

The oases with their date-palms, tarfa (or tamarisk) yielding manna, seyâl (or acacia) yielding gum-arabic, gharkad shrubs, and thickets of tall reeds, are veritable islands of fertility in an ocean of desolation. At the Monastery cypresses, oranges, peaches, and vines are cultivated, although 5,000 feet above the sea-level.

Naturalists enumerate a number of large animals that live in the oases of the desert, among them the gazelle, ibex, jackal, and fox. I met with the head of a gazelle and numerous horns of ibexes, and in Wadi Es-Sleh a



CHURCH OF THE TRANSFIGURATION (INTERIOR).

Bedouin suddenly appeared with two little half-tamed ibexes about fourteen days old ; my travelling companion bought them, but they were unable to withstand the novelty of camel-riding, and, though kindly cared for, died within a few days. Their skins were preserved. I noted on the journey a large field-mouse, a small light yellow snake  $2\frac{1}{2}$  feet long, and a peculiar kind of a lizard (?) At Assouan I killed an intensely energetic scorpion, and at many places noted chameleons basking in the sun. Of the numerous and curious fish in the Red Sea, I can only say that some of them proved to be excellent food.

Insects were rarely seen in the desert, and only in the neighborhood of water, or in the oases. I observed red and black ants, one large caterpillar, very few flies, many



black beetles, leaving behind them well-defined tracks as they crawled over the fine-grained sand, a few moths, a bee, a grasshopper, many spiders, a lady-bird (so-called), gnats near the sea-coast ; and my travelling companion noted fleas. Mosquitoes, so abundant in Cairo, were not seen nor heard. Twice large birds sailed high above our heads. This is the total of animal life met with in my four weeks' journey, excepting camels and goats.